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## आग प्रतिरोधी हाइड्रोलिक द्रव — विशिष्टि

भाग 5 आर्गेनिक ईस्टर टाईप

## Fire Resistant Hydraulic Fluids — Specification

Part 5 Organic Ester Type

ICS 75.100

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## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Lubricants and Their Related Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

The use of fire resistant hydraulic fluid is increasing due to a growing awareness of the dangers inherent in using mineral oil for applications where there is fire risk. There are mainly four types of fire resistant hydraulic fluid (FRHF) namely, dilute emulsion, invert emulsion, water glycols and synthetic fluids.

In synthetic fluids, FRHF based on phosphate esters are more commonly used. The manufacturers are recommending the use of fire resistant hydraulic fluid organic ester type to be used in machineries working below ground mines. They have high film strength and good lubrication on performance. Because of high thermal stability they can operate at temperatures up to 150°C depending upon the system design.

Other parts of the standard published so far are as follows:

- Part 1 : 1983 Dilute emulsions for powered supports
- Part 2 : 1983 Invert emulsions (water-in-oil) type
- Part 3 : 1983 Water glycol type
- Part 4 : 1983 Phosphate esters type.

Selection and uses of the fire resistant hydraulic fluid are covered in IS 10531 while determination of the fire resistant characteristic is given in IS 7895.

In the preparation of this standard considerable assistance has been derived from ISO 20811 and Luxembourg report.

For the purpose of deciding whether a particular requirement of this standard complied with, the final value, observed or calculated expressing the result of test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

# Indian Standard

## FIRE RESISTANT HYDRAULIC FLUIDS — SPECIFICATION

### PART 5 ORGANIC ESTER TYPE

#### 1 SCOPE

This standard (Part 5) prescribes the requirement and method of sampling and tests for fire-resistant hydraulic fluid organic esters type suitable for use in hydraulic control system.

#### 2 REFERENCES

The following standards contains provisions which through reference in this text constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revisions, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

		<i>IS No./ International Standard</i>	<i>Title</i>
		[P:67] : 1982	Foaming characteristics of lubricating oils ( <i>first revision</i> )
		[P:69] : 1969	Flash and fire point by cleveland open cup
		[P:87] : 1979	Autoignition temperature of liquid petroleum products
		[P:91] : 1979	Emulsion characteristics of petroleum oils and synthetic fluids
		[P:96] : 1980	Rust-preventing characteristics of steam-turbine oil in the presence of water
		[P:102] : 1981	Determination of air release value
		2362 : 1994	Determination of water by Karl Fischer method
		7895 : 1975	Tests for fire resistant characteristics of hydraulic fluids used in mining machinery
1447 : 2000	Petroleum and its products — Methods of sampling: Part 1 Manual sampling ( <i>first revision</i> )	ISO 6072 : 2011	Rubber — Compatibility between hydraulic fluids and standard elastomeric materials
1448	Methods of test for petroleum and its products:		
[P:2] : 1967/ ISO 6619 : 1988	Petroleum products and lubricants — Neutralization number potentiometric titration method ( <i>second revision</i> )	ISO 14635-1 : 2000	Gears — FZG test procedures — Part 1: FZG test method A/8, 3/90 for relative scuffing load-carrying capacity of oils
[P:4] : 2008/ ISO 6245	Ash, sulphated ash and water soluble ash ( <i>second revision</i> )	ASTM D 2070-91 (2010)	Standard test method for thermal stability of hydraulic oils
[P:10/Sec 2] : 2013/ISO 3016 : 1994	Cloud point and pour point ( <i>second revision</i> )	ASTM D 2619-09	Standard test method for hydrolytic stability of hydraulic fluids (beverage bottle method)
[P:15] : 2004/ ISO 2160 : 1998	Petroleum products — Corrosiveness to copper — Copper strip test ( <i>third revision</i> )	ASTM D 4172-94 (2010)	Standard test method for wear preventive characteristics of lubricating fluid (four-ball method)
[P:16] : 1990	Density, relative density or API gravity of crude petroleum and liquid petroleum products by hydrometer method	ASTM D 5864-11	Standard test methods for determining aerobic aquatic biodegradation of lubricants or their components
[P:25] : 1976	Determination of kinematic and dynamic viscosity ( <i>first revision</i> )	ASTM D 6546-00 (2010)	Standard test methods for and suggested limits for determining compatibility of elastomer seals for industrial hydraulic fluid applications
[P:32] : 1992	Density and relative density ( <i>second revision</i> )		
[P:56] : 1980	Viscosity index by calculation ( <i>second revision</i> )	ASTM D 7043-12	Standard test method for

## IS 10532 (Part 5) : 2016

<i>IS No./ International Standard</i>	<i>Title</i>
	indicating wear characteristics of non-petroleum and petroleum hydraulic fluids in a constant volume pump
DIN EN 14833	Petroleum and related products — Determination of hydrolytic stability of fire-resistant phosphate ester fluids
NAS 1638	Cleanliness requirements of parts used in hydraulic systems

### 3 GRADES

**3.1** The fire resistant hydraulic fluid shall be in viscosity grades, namely VG-22, VG-32, VG-46 and VG-68 designated as HFDU-22, HFDU-32, HFDU-46 and HFDU-68.

### 4 GENERAL REQUIREMENTS

#### 4.1 Description

The material shall be clear and bright fluid, free from foreign matter, sediment and visible impurities. It shall not contain any ingredients injurious to persons using or handling it.

#### 4.2 Composition

The material shall be blend of organic esters with additives necessary for desirable antioxidant, anti-rust and anti-foaming properties.

**4.3** The material shall also comply with the requirements prescribed when tested according to the appropriate methods specified in col 7 of Table 1.

**4.4** Fire resistant characteristics, thermal stability, four ball test, pump wear test to give it complete, FZG EP test (fail load stage) and biodegradability requirements shall be type tests.

### 5 PACKING AND MARKING

#### 5.1 Packing

The material shall be packed in suitable containers as

agreed between the purchaser and the supplier. Galvanized drum/barrel shall not be used for packing these fluids.

#### 5.2 Marking

The containers shall be securely closed and marked with the following: name of manufacturer, name, type, grade and mass of the material, recognized trade-mark, if any, and with identification in code or otherwise to enable the lot of consignment or manufacturer to be traced back and the instruction for use.

**5.2.1** The product may also be marked with the Standard Mark.

**5.2.2** The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

### 6 SAMPLING

**6.1** Representative samples of the material shall be drawn as prescribed in IS 1447 (Part 1).

### 7 STORAGE

**7.1** The material shall be stored and handled, strictly in accordance with the supplier's instructions.

### 8 SAFETY PRECAUTIONS

**8.1** While handling these fluid the following safety precautions shall be observed:

- The fluid doesn't cause skin irritation ordinarily but wearing of protective clothing is recommended.
- Continued exposure to the fumes should be avoided and breathing vapours from heated or burning product should also be avoided.
- Smoking, eating or drinking shall be prohibited when these fluids are being handled.

**Table 1 Requirements for Fire Resistant Hydraulic Fluid — Organic Ester Type**  
(Clause 4.3)

Sl No.	Characteristics	Requirements (U Type)				Method of Test, Ref to
		HFDU-22	HFDU-32	HFDU-46	HFDU-68	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Appearance	Clear and Bright	Clear and Bright	Clear and Bright	Clear and Bright	—
ii)	Water content, percent by volume, <i>Max</i>	0.1	0.1	0.1	0.1	IS 2362
iii)	Kinematics viscosity at 40°C, cSt	19.8-24.2	28.8-35.2	41.4-51.6	61.2-74.8	IS 1448 [P : 25]
iv)	Viscosity index, <i>Min</i>	175	175	175	175	IS 1448 [P : 56]
v)	Air release properties, minutes, <i>Max</i> at 50°C	10	12	15	25	IS 1448 [P : 102]
vi)	Relative density 15°C	0.90-0.99	0.90-0.99	0.90-0.99	0.90-0.99	IS 1448 [P : 16] and [P : 32]
vii)	Emulsion characteristics, 30 min, <i>Max</i> (oil-water-cuff)	40-37-3	40-37-3	40-37-3	40-37-3	IS 1448 [P : 91]
viii)	Total acidity mg KOH/g, <i>Max</i>	2.0	2.0	2.0	2.0	IS 1448 [P : 2]
ix)	Foaming characteristics, tendency/stability, ml, <i>Max</i> Sequence I Sequence II Sequence III	150/10 300/10 150/10	150/10 300/10 150/10	150/10 300/10 150/10	150/10 300/10 150/10	IS 1448 [P : 67]
x)	Corrosion copper strip at 100°C, 3 h, <i>Max</i>	1	1	1	1	IS 1448 [P : 15]
xi)	Rust prevention characteristics, 4 h	Pass	Pass	Pass	Pass	IS 1448 [P : 96]
xii)	Ash content, percent by mass, <i>Max</i>	0.03	0.03	0.03	0.03	IS 1448 [P : 4]
xiii)	Hydrolytic stability — Acid number increase, mg KOH/g, <i>Max</i>	4.0	4.0	4.0	4.0	ASTM D 2619/ DIN EN 14833
xiv)	Elastomer compatibility: 100°C /168 Hr FPM 1, NBR 1 Elastomers a) Relative volume change, percent, <i>Max</i> b) Relative hardness change, <i>Max</i>	± 7 ± 7	± 7 ± 7	± 7 ± 7	± 7 ± 7	ASTM D 6546/ ISO 6072
xv)	Flash point, COC, °C, <i>Min</i>	250	250	250	250	IS 1448 [P : 69]
xvi)	Fire point COC, °C, <i>Min</i>	270	270	290	290	IS 1448 [P : 69]
xvii)	Auto-ignition temperature, °C, <i>Min</i>	340	340	370	370	IS 1448 [P : 87]
xviii)	Pour point °C, <i>Max</i>	−12	−12	−09	−09	IS 1448 [P : 10/Sec 2]
xix)	Fire resistant characteristics	Pass All	Pass All	Pass All	Pass All	IS 7895
xx)	Thermal stability CM(A) @135°C/168 h a) percent viscosity change at 40°C, <i>Max</i> b) TAN change, mg KOH/g, <i>Max</i> c) Sludge content mg/100 ml, <i>Max</i> d) Copper rod mass loss, mg, <i>Max</i> e) Copper rod rating, <i>Max</i>	10 4.0 25 10 5	10 4.0 25 10 5	10 4.0 25 10 5	10 4.0 25 10 5	ASTM D 2070
xxi)	Four ball test, 40 kg, 1200 RPM, 75°C, 1 h Scar dia, mm, <i>Max</i>	0.5	0.5	0.5	0.5	ASTM D 4172
xxii)	Pump wear test, total ring and vane mass loss, mg, <i>Max</i>	150	150	150	150	ASTM D 7043
xxiii)	FZG EP test, fail load stage, <i>Max</i>	10	10	10	10	ISO 14635-1
xxiv)	Biodegradability, percent, <i>Min</i>	70	70	70	70	ASTM D 5864

NOTE — 'Cleanliness' — As agreed between the user and the supplier.



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## Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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